Rotorcraft On-Blade Pressure and Strain Measurements Using Wireless Optical Sensor System, Phase I

Completed Technology Project (2007 - 2007)

Project Introduction

Experimental measurements of rotor blades are important for understanding the aerodynamics and dynamics of a rotorcraft. This understanding can help in solving on-blade problems as well as in designing and optimizing the blade profiles for improved aerodynamics and noise attenuation in the next generation rotorcraft. Therefore, a Wireless Optical Pressure/Strain Sensor (WOPSS) system for helicopter on-blade pressure and strain measurement is proposed to utilize the benefits of low coherence interferometry system to create an innovative real-time pressure and strain measurement technique. Leveraging past and current experiences with fiber optic sensor development, a proof-of-concept of optical pressure/strain sensor system with wireless data acquisition and transfer capability will be demonstrated at the end of Phase I. The distributed optical pressure/strain sensor measurements will be used to obtain real-time dynamic pressure fields and mode shapes and displacements by integrating strain data for the helicopter rotor blade. Phase I efforts will conduct optical pressure and strain sensor design analysis to meet on-blade pressure and strain measurement requirements and demonstrate a proof-of-concept prototyped wireless optical pressure and strain sensor package.

Anticipated Benefits

The WOPSS technology will be applicable to a wide range of end-users in the defense, commercial, and industry sectors. TSi's WOPSS will be an integrated software/hardware product that can be licensed for manufacture to our strategic manufacturing partner, or a similar rotorcraft producer, depending on the market being addressed. Because TSi already enjoys market share of adaptive materials for precision control of structures, noise, weapons effectiveness, etc., through our existing customers, we plan to leverage these marketing outlets and offer WOPSS systems for enhanced performance where conventional sensors have not been successful from performance and cost perspective. TSi will finalize a formal partnership with a strategic manufacturing partner, who will produce the WOPSS systems specific to commercial rotorcraft. TSi will partner with an OEM manufacturer in an appropriate field of use (e.g., electro-optics manufacturer, weapons systems integrator, aircraft OEM, etc.) to modify the WOPSS as a generic sensor. We will perform final systems integration of the WOPSS systems and conduct direct marketing and sales of the product to the end-use through our internal resources.

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Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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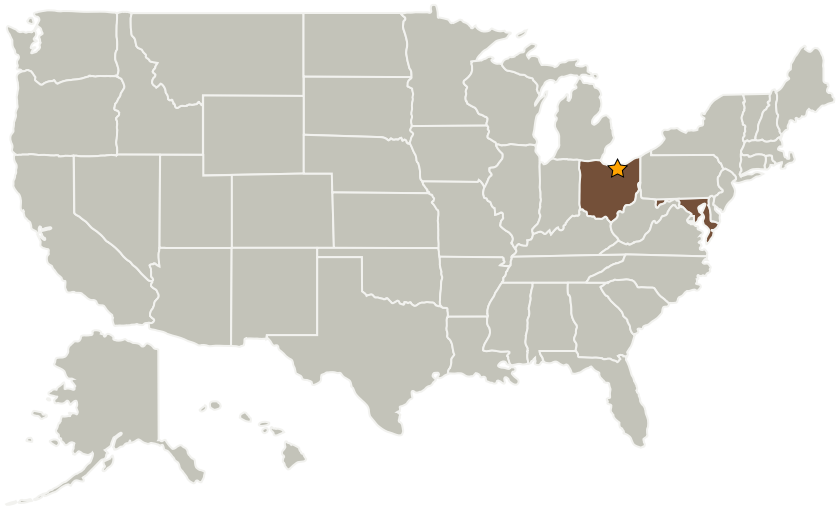
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Techno-Sciences, Inc.	Supporting Organization	Industry	Beltsville, Maryland

Primary U.S. Work Locations	
Maryland	Ohio

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Project Manager:
Robert S Okojie

Principal Investigator:
Gang Wang

Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
  - TX09.4 Vehicle Systems
    - TX09.4.6 Instrumentation and Health Monitoring for EDL